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54 Press especially adapted to the moulding of tiles.

57 A ceramics mould with a mobile die has its die (7) mounted on elastic supports (10) and provided with through cavities (66) for moulding the tiles (70), it lying between an upper plate (11, 12) and a lower plate (1), to the first (11, 12) of which there being fixed, by way of rear elastic bearings (14), a series of punches (13) for forming the exposed face of the tiles

(70). Each upper punch (13) is received with an exact fit in a respective perimetral frame (20) the lower face of which extends beyond the working surface of the respective punch (13), the dimensions of this latter being slightly less than the dimensions of the underlying moulding cavity (66).

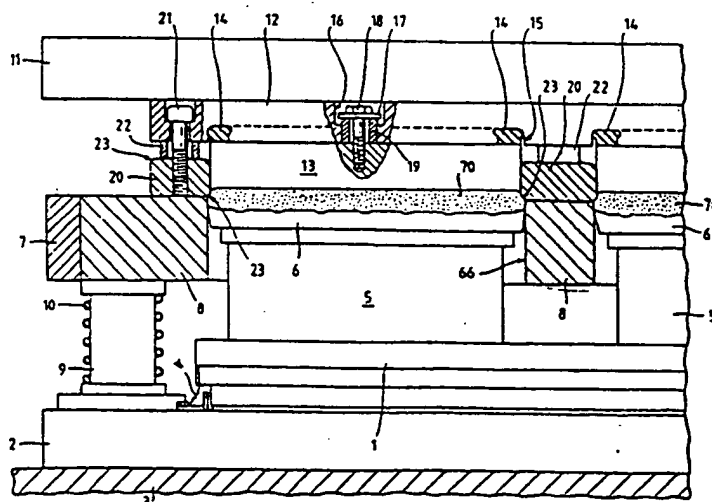


Fig. 2.

TITLE MODIFIED
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CERAMICS MOULD WITH MOBILE DIE FOR MOULDING TILES OF ANY FORMAT AND
TILES WITH A MULTI-COMPONENT SUPPORT, SUCH AS PRESS-GLAZED TILES

5 This invention relates to an improved mould of the mobile die type,
for producing tiles of any shape and format and tiles with a support
comprising two or more components.

10 Normal ceramics moulds are known to comprise an upper plate provided
lowerly with a series of pressing punches, an intermediate plate
or die with a corresponding number of through moulding cavities into
which the soft clay to be compacted is loaded, and a lower plate
provided upperly with a series of pressing punches arranged to close
said cavities at their base and to extract the moulded tiles from
them.

15 In known ceramics moulds, the upper plate is fixed to the mobile
cross-member of the corresponding press, the die is supported by the
press base, and the lower plate is mobile vertically to extract the
tiles as stated, and rests on the press base during the pressing
20 stages.

Moreover, in certain types of mould the die is locked in a fixed
position on the press base, whereas in other types of mould, to
which the invention particularly relates, the die is mounted on
25 elastic supports so that during the pressing stages it can be urged
downwards by the upper plate as it descends.

Ceramics moulds with a mobile die have the advantage over fixed-die

moulds of more uniformly compacting the tiles due to the fact that they press these latter by acting on both their faces, with well known advantages.

5 In contrast to fixed-die moulds, ceramics moulds with a mobile die have their reverse-face and obverse-face punches, for forming the rear or reverse face and the front or obverse face of the tiles respectively, fixed to the upper plate and lower plate of the mould. The reason for this is that if they were arranged in the opposite
10 manner an undercut would be formed which would prevent extraction of the tiles.

Notwithstanding the known advantages due to the more or less uniform tile compaction, known mobile-die moulds are not suitable for produ-
15 cing certain ceramic materials which are currently much in demand.

For example, such moulds are not convenient for the production of large-format tiles, for example having dimensions of 40 x 60 cm, 60 x 60 cm or 60 x 90 cm. Neither are they suitable for producing
20 tiles in which the reverse face comprises projections such as faceted protuberances or so-called "orange peel" surfaces, for producing tiles formed from a mixture of at least two differently coloured clays, for producing tiles in which the starting material is a mixture of atomised clay and at least one natural powdered material such as
25 marble, or for producing press-glazed tiles such as tiles formed from a mixture of basic atomised clay and a small percentage of atomised glaze, ie from normal atomised clay on which a thin film of atomised glaze, which may be distributed uniformly or non-uniformly, is applied to the clay after it has been loaded into the die but
30 before pressing.

Because of the aforesaid necessary arrangement of the reverse-face and obverse-face punches, which as stated are situated respectively above and below the mobile die of the mould, the following drawbacks
35 arise:

a) During the loading of soft clay containing one or more components,

the finer powder becomes more concentrated on the obverse-face punch so that the exposed surface of the tile, whatever its format, has poor porosity which hinders regular and uniform grip and distribution of the glaze. This is important in that modern production cycles use very thin layers of glaze.

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b) Small incisions or scoring are formed on the exposed faces of the tiles, particularly those of large format, and these are visible even after the glazing and firing. This is because such particularly heavy tiles on being removed from the mould are slid along the die, on which clay granules are normally present. The same problems also arise in the production of tiles formed from mixtures of different coloured clays, or mixtures of clay and powdered natural materials, whether they are to be glazed or not. The so-called press-glazed tiles also become scored in this manner on removal.

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c) Such large-format tiles must necessarily be turned over after their removal from the mould, and a certain number of them break and become damaged during this operation, as the tiles are very delicate when they have just been moulded and are extremely sensitive to impact and/or vibration.

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d) In the case of those tiles with relief patterns on their obverse face, these are even more subject to scoring and incision, and to more serious damage, and in addition as these relief parts are slid along the raised edge of the obverse-face punches, they rapidly wear the said raised edge. This is important because the said raised edge cooperates in forming the obverse face of the tile.

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e) Finally, in mobile-die moulds of known type, there are also problems in deaerating the material to be compacted. In the known prior art, deaeration takes place through the spaces between the upper and lower punches and the respective moulding cavity, but mainly through the lower space because the upper

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punch practically seals the cavity during pressing, whereas the lower punch is inserted into the same cavity with a certain amount of play. Because of this play, a very small rib or burr of strongly compacted earth forms around the front face of the tile, and it mostly falls on to the obverse-face punch during the removal of the tile. This burr, being strongly compacted, does not perfectly adhere to the exposed face of the next tile, thus producing a poor quality material. Moreover, this practically only vent path for the air present in the soft clay often means that the press has to be operated at its maximum power to obtain the necessary deaeration of large-format tiles, because of the fact that the lower vent space cannot be enlarged beyond certain limits.

15 The present patent provides and protects an improved mobile-die ceramics mould which is able to obviate the aforesaid drawbacks by means of a simple and rational design.

20 The fundamental idea on which the invention is based is to form the reverse face of the tile within the moulding cavity, and the obverse face of the tile immediately outside the moulding cavity.

In the structure according to the invention used for this purpose, the reverse-face and obverse-face punches are fitted to the lower and upper plates of the mould respectively, and about each individual upper or obverse-face punch there is disposed a series of peripheral fillets which extend endlessly about the respective punch to form an enclosing frame, the lower perimetral edge of which slightly extends beyond the active face of the punch. Furthermore, according to the invention each upper punch is fitted to its plate by way of convenient elastic bearings, and is received practically as an exact fit within said frame, the space enclosed by this latter being coaxial with the underlying moulding cavity, and having slightly smaller dimensions than said cavity. Finally, said frame comprises a flared mouth which smoothly joins the working surface of the punch to the lower perimetral edge of the frame itself, the dimensions of

said mouth being the same as the dimensions of the moulding cavity.

Because of the aforesaid characteristics, during a pressing stage the frames as they descend rest against the die so that they embrace the upper mouth of the moulding cavity, then on moving the die downwards the effect is as if the lower punches slide against the upper punches so that the tile becomes pressed on both faces.

At a certain point the pressing force exceeds the preload of the elastic supports for the upper punches, which withdraw to rest against their plate, and as the descent of this latter continues the tile becomes finally formed and compacted on both sides as stated heretofore.

Compared with the prior art described in the introduction, a mould according to the invention has the following advantages.

- A. The inverted arrangement of the reverse-face and obverse-face punches, these latter situated upperly, prevents concentration of the finer powder on the exposed or obverse face of the tile, thus obviating the problems deriving from this.
- B. The scoring and incision problem of the obverse face of the tile is also overcome, as the tile is ejected the right way up.
- C. The risk of breakage or damage to large-format tiles is almost non-existent as the tiles do not have to be turned over after their ejection, because of that stated under the preceding point.
- D. The tiles can be produced with any type of relief pattern as the obverse side is not made to slide along hard dust-covered surfaces, and the raised edge of the obverse-face punch is not subjected to damaging sliding as it is situated external to the path followed by the tile being ejected.

E. With the mould according to the invention there is also excellent clay deaeration as the tile is formed partly within the moulding cavity and partly outside it. In this manner there are three vent paths, the first between the lower punch and the die, the
5 second between the upper punch and its frame, and the third between said frame and die. The drawbacks relating to the burrs described heretofore under point e are also obviated.

Finally, means are also provided according to the invention for
10 guiding and retaining the upper or obverse-face punches, and for preventing warping of those sides of the frames which face outwards from the mould, and which could deform laterally because of the high horizontal components of the forces in play.

15 The characteristics and constructional merits of the invention will be more apparent from the detailed description given hereinafter with reference to the figures of the accompanying drawings, which illustrate a preferred embodiment thereof by way of example.

20 Figure 1 is a partial vertical section through the invention in its open position at the end of the loading stage.

Figure 2 is a view similar to the preceding, with the mould shown at the end of a pressing operation.

25 Said figures show a robust lower metal plate 1 which is disposed on a platform 2, this latter being fixed on a normal pressing bed 3 provided on a likewise normal base of a ceramics press (not shown), which can be of hydraulic or friction type.))

30 Between said platform 2 and plate 1 there is provided a perimetral dust protection bellows 4 of known type. On the plate 1 there is disposed a series of metal blocks 5 which support respective reverse-face punches 6, ie for forming the rear or reverse face of the tiles
35 70 (Figure 2).

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The elements 1, 5 and 6 can be fixed together in any known manner, for example by mechanical means, magnetic means or a combination of said two systems. The working surface of the punches 6 can be of metal or rubber.

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Said punches 6 are permanently inserted, from below, into respective moulding cavities 66 pertaining to an intermediate plate 7 commonly known as the die.

10 In the usual manner, each moulding cavity 66 is bounded by a series of elongated elements 8, known as bars, which are constructed of a high-quality, hard metal material. It should also be noted that in the illustrated case, said bars 8 are of double utilisation type, ie when their upper face is worn they can be turned over to make use
15 of their lower face.

It should also be noted that the lower plate 1 is made to slide vertically in known manner by a known device housed in the press base.

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As shown, a series of robust cylindrical columns ⁹ project downwards from the die and are slidably mounted in respective guide seats in the platform 2, over said columns 9 there being mounted compression springs 10 for keeping the die 7 in its correct completely raised
25 operating position. Above the die 7 there is disposed a robust upper plate 11 fixed in known manner to the mobile cross-member of said ceramics press. As shown in both the accompanying figures, below the upper plate 11 there is fixed a plate 12 acting as the single support element for the upper punches 13, which according to the
30 invention are of the obverse-face type, ie for forming the front or obverse face of the tiles 70. As in the case of the punches 6, the working face of the upper punches 13 can be of metal or rubber, and the elements 11 and 12 can be fixed together in any known manner, for example by mechanical or magnetic means.

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Said punches 13 are of usual type, ie comprising a working surface

constituted by a central depressed zone which is joined to the side walls of the punch 13 by a small concave arcuate portion. In addition, between each punch 13 and the respective plate 12 there is disposed a concentric elastic ring 14, for example of rubber construction, the top of which is housed in a suitable seat in the plate 12, and the bottom of which simply rests on the punch 13 to keep it elastically urged downwards. There is a small gap (Figure 1) between the punch 13 and plate 12, and the maximum downward travel of the punch is determined by at least one guide and stop member, the number of these members obviously depending on the surface area of the block 13. Said at least one member comprises a through bore 16 of different cross-sections, which is provided in the plate 12 so as to form a shoulder for the washer 17 of a screw 18 which is screwed into the underlying block 13. A slide bush 19 is mounted slackly on the screw 18 and is strongly clamped between the punch 13 and washer 17 which acts as an anti-withdrawal element for the screw 18, the bush being free to slide in the wider part of said screwed bore 16.

In addition, each upper punch 13 is enclosed, practically as an exact fit, by a perimetral frame comprising a series of consecutive metal fillets 20 fixed to the overlying plate 12 by a convenient number of screws 21, by way of suitable spacer bushes 22.

The edges of each fillet 20 are provided with small identical bevels 23 along their entire length to enable the outer fillets 20 and those situated between two adjacent cavities 66 to be used on all four sides and on two sides respectively.

Finally, the dimensions of the punch 13 are slightly less than those of the moulding cavity 66, and when the mould is open as shown in Figure 1 the inner edges of the bevels 23 practically coincide with the perimetral edge of the working face of the punch 13 (Figure 1), whereas the outer edges of said bevels 23 define an aperture which is identical to the shape of the moulding cavity 66 (see Figure 2).

When the upper plate 11 is lowered, the frames 20 and punches 13 enclose and cover the upper mouths of the moulding cavities 66, and the die 7 moves downwards. The effect is therefore as if the lower punches slide against the upper ones, and the clay 77 is
5 pressed both from above and from below, with partial emergence of the said clay 77, or other mixture as stated in the introduction, from the moulding cavity.

10 During the initial pressing stage the elastic rings 14 remain in the undeformed configuration shown in Figure 1, whereas almost at the end of said pressing stage said rings 14 become compressed into their seats 15, with simultaneous withdrawal of the upper punches 13 to rest against the plate 12. By the end of the descent of the
15 plate 11, the tile 70 (Figure 2) has been perfectly formed by pressing both from above and from below as stated, by virtue of said movement of mutual approach of the upper punches 13 and lower punches 6.

It should be noted that the tile is partly formed in the cavity 66 and partly formed outside it as shown in Figure 2, and the particular
20 dimensioning of the parts designed to give the tile its shape enables the characteristic perimetral rim to be obtained, which in known manner prevents damaging contact between the edges of the exposed surface of the tiles during the subsequent processing cycles to which they are subjected, for example their transfer by conveyor belt
25 along single-layer firing kilns.

Finally, although not shown, means can be provided according to the invention for preventing warping of those fillets 20 which face
30 outwards from the mould, such as that fillet 20 which is situated on the extreme left in the figures, and which can occur when high-power presses are used for obtaining large formats such as 33 x 33 cm, 45 x 45 cm and larger.

Said means can for example comprise a series of pegs with an enlarged
35 head which branch from the corresponding side of the upper punch and are slidably received in vertically extending slotted apertures,

these latter being provided in the fillet 20 between the bores into which the screws 21 are screwed.

5 The enlarged head of the peg is obviously positioned against the outer face of said fillet.

In an alternative embodiment, an anti-warping element can be used fixed to the plate 12 or plate 11, and extending downwards practically in contact with said outer face of said fillet 20.

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The advantages of the invention have been amply stated in the introduction, in comparison with the known prior art.

15 The invention is not limited to the single embodiment illustrated and described, but comprises all technical equivalents of the aforesaid means and their combinations, where covered by the following claims.

PATENT CLAIMS

1. A ceramics mould with a mobile die, of the type comprising an upper plate (11) fixable to the cross-member of a ceramics
5 press, an intermediate plate (7) mounted on elastic supports (10) and provided with a series of through moulding cavities (66), a lower plate (1) driven to slide vertically, and two series of pressing punches associated with said lower and upper plates and provided for forming the laying and exposed faces of the tiles
10 (70) respectively, characterised in that the punches (13) for forming the exposed face of the tiles (70) are applied to the upper plate (11) of the mould by way of rear elastic bearings (14), and have dimensions slightly less than those of the underlying moulding cavities (66), each upper punch (13) being enclosed with a precise
15 fit by a perimetral frame (20) the lower face of which slightly passes beyond the working surface of the respective upper punch (11), said frame (20) having a flared mouth (23) which connects the working surface of the punch (11) to the upper mouth of the corresponding moulding cavity (66).

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2. A mould as claimed in claim 1, characterised in that said elastic bearings each comprise a rubber ring (14) disposed concentrically to its punch (13) and clamped between this latter and the corresponding connection plate (11, 12) in which a respective engagement
25 seat (15) is provided, between said punch (13) and plate (11, 12) there being normally provided a small gap for the free retraction of said punch (13).

3. A mould as claimed in claim 1, characterised in that on the
30 rear of each upper punch (13) there is provided at least one guide/stop member comprising, fixed to said punch, a pin (18) with an enlarged head (17) and slidingly mounted in its own seat (16) provided in said plate (11, 12), said seat (16) being provided with an anti-withdrawal shoulder for said enlarged head (17).

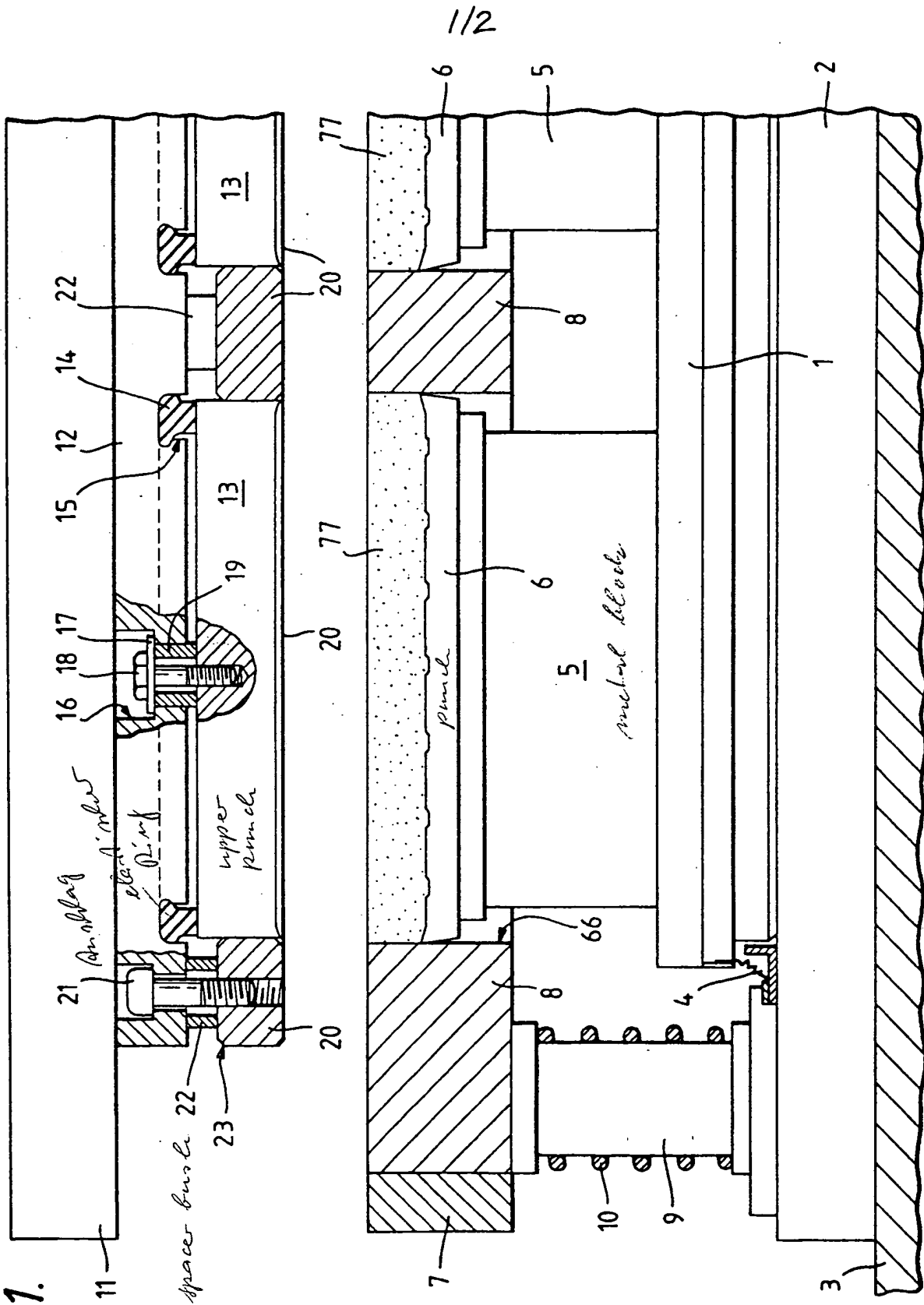
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4. A mould as claimed in claim 1, characterised in that each

frame comprises a series of fillets (20) fixed without discontinuity against the upper plate (11, 12) and about the respective punch (13), that edge of each fillet (20) which faces the working surface of the punch (13) comprising over its entire length a small bevel (23) the
5 inner edge of which coincides practically with the adjacent edge of the working surface of the punch (13), and the outer edge of which is exactly aligned with the corresponding edge of the mouth of the underlying moulding cavity.

10 5. A mould as claimed in claim 1, characterised in that on those sides of the upper punches (13) which face outwards from the mould there is provided at least one anti-warping element for the respective fillet (20), said element comprising a large-headed peg fixed into the side of the punch and having its shank received in
15 a vertically extending slotted passage provided in the fillet, the enlarged head of said peg being positioned on the outside of the fillet.

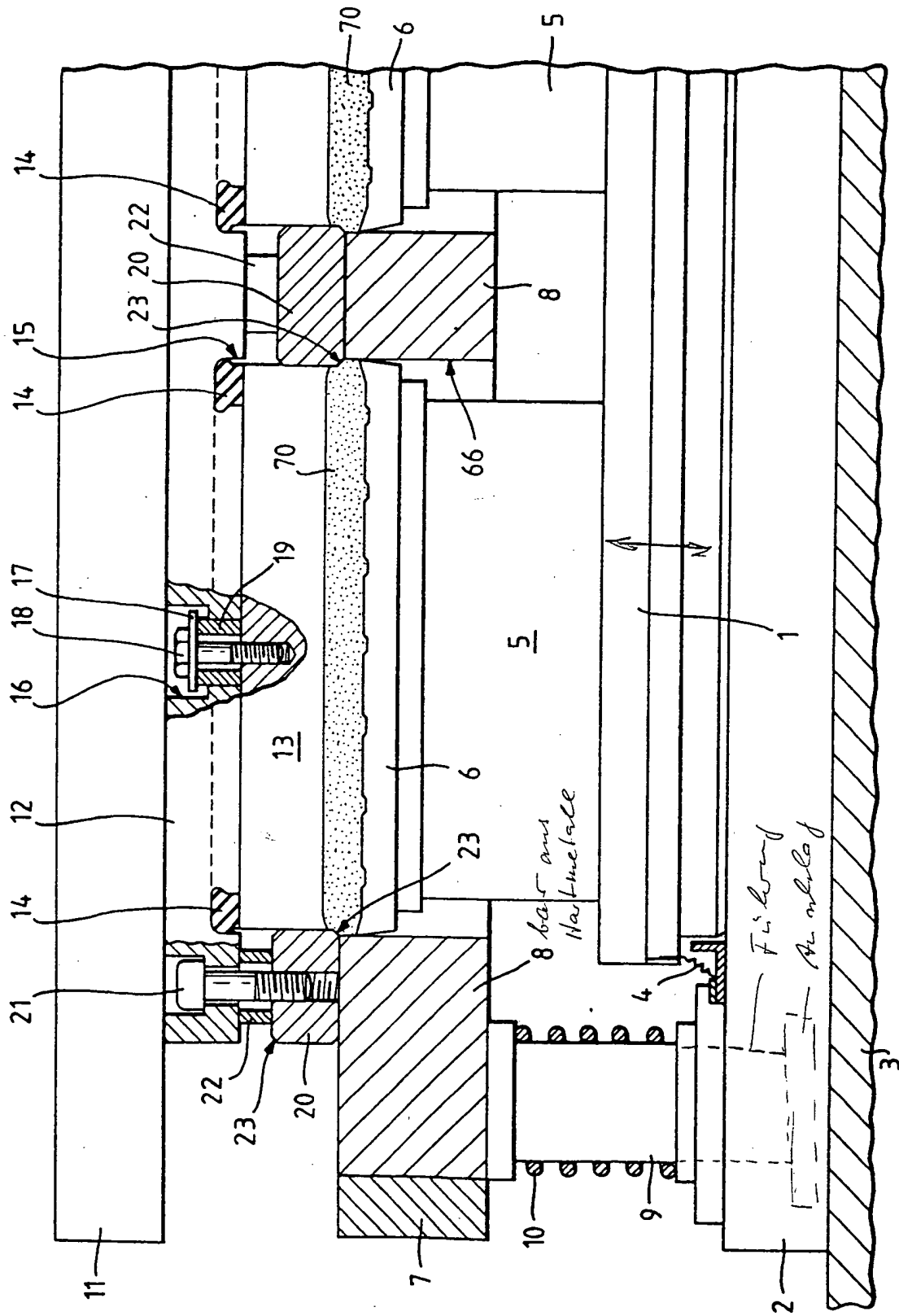
20 6. A mould as claimed in claim 1, characterised in that said at least one anti-warping element consists of a section bar fixed to the upper plate (11, 12) and extending downwards practically in contact with the outer face of said fillet (20).

Fig. 1.



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Fig. 2.



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European Patent
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EUROPEAN SEARCH REPORT

Application number

| DOCUMENTS CONSIDERED TO BE RELEVANT | | | EP 86200079.1 |
|---|---|--|---|
| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int. Cl.4) |
| X | GB - A - 2 025 834 (MERISINTER) * Fig. 1,2A * -- | 1 | B 28 B 3/08 B 30 B 15/06 |
| A | GB - A - 2 031 788 (PTX-PENTRONIX INC.) * Fig. 2 * -- | 1 | |
| A | FR - A1 - 2 445 204 (CONSTRUCTIONS) * Fig. 7 * ---- | 3 | |
| The present search report has been drawn up for all claims | | | TECHNICAL FIELDS SEARCHED (Int. Cl.4) |
| | | | B 28 B B 30 B |
| Place of search VIENNA | | Date of completion of the search 01-08-1986 | Examiner GLAUNACH |
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